I CLAIM:

1. A projection objective with an object plane and an image plane and a light path for a bundle of light rays from the object plane to the image plane for use in short wavelength microlithography, comprising;

six mirrors (a first mirror (S1), a second mirror (S2), a third mirror (S3), a fourth mirror (S4), a fifth mirror (S5) disposed closest to the image plane and a sixth mirror (S6)) arranged in the light path such that an image-side numerical aperture (NA) is NA $\geq$ 0.15, wherein each mirror has a physical mirror surface and wherein said fifth mirror is positioned in the light path such that at least one of the following conditions is satisfied:

an image-side optical free working distance is greater than or equal to a used diameter D of a physical mirror surface of the fifth mirror;

the image-side optical free working distance is greater than or equal to a sum of one-third of the used diameter of the physical mirror surface of the fifth mirror and a length between 20 mm and 30 mm; and

the image-side optical free working distance is at least 50 mm;

wherein the image side free working distance is the physical distance between the vertex of the surface of the fifth mirror and the image plane and wherein the physical mirror surface of a mirror is the area of the surface of a mirror, where the rays of the bundle of light rays running from the object side to the image side impinge.

2. A projection objective with an object plane and an image plane and a light
path for a bundle of light rays from the object plane to the image plane for use in short wavelength microlithography, comprising;

six mirrors (a first mirror (S1), a second mirror (S2), a third mirror (S3), a fourth mirror (S4), a fifth mirror (S5) disposed closest to the image plane, and a sixth mirror (S6)) arranged in the light path such that an image-side numerical

aperture (NA) is NA ≥ 0.15 and an image side arc-shaped field width (W) lies in the range of $1.0 \text{ mm} \leq W$, and wherein each of said six mirrors has a physical mirror surface with a maximum aspherical peak-to-valley (PV) deviation (A) from a best-fitting sphere in the following range:

$$A \leq 19\ \mu m - 102\ \mu m\ (0.25 - NA) - 0.7\ \mu m/mm\ (2\ mm - W)$$

wherein the physical mirror surface of a mirror is the area of the surface of a mirror where the rays of the bundle of light rays running from the object side to the image side impinge.

3. A projection objective with an object plane and an image plane and a light path for a bundle of light rays from the object plane to the image plane for use in short wavelength microlithography, comprising;

six mirrors (a first mirror (S1), a second mirror (S2), a third mirror (S3), a fourth mirror (S4), a fifth mirror (S5) disposed closest to the image plane, and a sixth mirror (S6)) arranged such that an image-side numerical aperture (NA) is NA ≥ 0.15 and an image-side arc-shaped field width (W) lies in the range of $1.0 \text{ mm} \leq W$, and wherein the rays of a bundle of light rays incident on each physical mirror surface of the six mirrors have angles of incidence (AOI) relative to the surface normal of said physical mirror surface that are lying in the range:

$$AOI \leq 23° - 35°\ (0.25 - NA) - 0.2°/mm\ (2\ mm - W)$$

wherein the physical mirror surface of a mirror is the area of the surface of a mirror where the rays of the bundle of light rays running from the object side to the image side impinge.

4. A projection objective with an object plane and an image plane and a light path from the object plane to the image plane for use in short wavelength microlithography, comprising;

a field mirror (S1) with an imaging ratio $\beta_1 > 0$, wherein the field mirror produces a virtual image of an object in the object plane;

a first subsystem with a second mirror (S2), a third mirror (S3), and a fourth mirror (S4), wherein the first subsystem has an imaging ratio $\beta_2 < 0$, and wherein said first subsystem images the virtual image to a real intermediate image;

a second subsystem with a fifth mirror (S5) disposed closest to the image plane and a sixth mirror (S6), wherein the second subsystem images the intermediate image to a real image in the image plane; and

wherein the objective has an image-side numerical aperture (NA) and an arc-shaped field width (W) in the image plane, where an object to be illuminated is situated, and wherein each mirror has a physical mirror surface that is the area of the surface of the mirror where the rays of the bundle of light rays running from the object side to the image side impinge.

5. A projection objective according to any one of Claims 1 to 4, wherein the surface of the mirrors have a rotational symmetry with respect to a principal axis (PA).

6. A projection objective according to one of Claims 1 to 4, further comprising an aperture stop (B) in the light path positioned between the second mirror (S2) and the third mirror (S3).

7. A projection objective according to Claim 6, wherein a ratio of a physical distance between the vertex of the surface of the first mirror and the vertex of the surface of the third mirror (S1S3) to a physical distance between the vertex of the surface of the first mirror and the vertex of the surface of the second mirror (S1S2) is in the range of:

$$0.5 < S1S3/S1S2 < 2.$$

8. A projection objective according to Claim 7, wherein a ratio of a physical distance between the vertex of the surface of the second mirror and the vertex of the surface of the third mirror (S2S3) to a physical distance between the vertex of the surface of the third mirror and the vertex of the surface of the fourth mirror (S3S4) lies in the range:

$$0.7 < S2S3/S3S4 < 1.4.$$

9. A projection objective according to any one of Claims 1 to 4, wherein all physical mirror surfaces are aspherical.

10. A projection objective according to any one of Claims 1 to 4, wherein at most five physical mirror surfaces are aspherical.

11. A projection objective according to any one of Claims 1 to 4, wherein the second mirror, third mirror, fourth mirror, fifth mirror, and sixth mirror are in a concave-convex-concave-convex-concave sequence.

12. A projection objective according to any one of Claims 1 to 4, wherein a physical distance between the vertex of the surface of the third mirror and the vertex of the surface of the sixth mirror (S3S6) satisfies the following relationship:

0.3 (used diameter of third mirror S3 + used diameter of sixth mirror S6) < S3S6.

13. A microlithography projection exposure apparatus comprising:

a projection objective according to one of the claims 1 to 4; and

an illumination system comprising a radiation source providing a bundle of light rays illuminating a arc-shaped field in the object plane of the projection objective, wherein the projection objective images a mask located in the object plane into the image plane of the projection objective, where a light sensitive objective is situated.

14. A method for producing a microelectronic device with a microlithography exposure apparatus according to claim 13 wherein a mask with a structure in the object plane is illuminated and said mask is imaged onto a light sensitive object situated in the image plane.